Chemistry I
Chapter1/2: Matter

Introduction

- Chemistry is defined as the study of matter and its changes

Types of Chemistry:

Two Types

- Pure Chemistry - chemical knowledge just to find out why
- Applied Chemistry- chemical knowledge used to make useful materials

Organic Chemistry- study of carbon and carbon based compounds and their changes

Inorganic Chemistry- study of all other elements and their changes

Matter

- Is anything that has mass and volume

Matter

- Two definitions:
  - Mass is the amount of matter something has
  - Volume is the amount of space something occupies

Law of Conservation of Matter

- Matter cannot be created nor destroyed in *ordinary* chemical reactions
- Falls apart in nuclear reactions

Properties of Matter

- Properties are characteristics that allow us to tell one kind of matter from another

Two Properties of Matter

1) Physical Properties can be observed or measured

2) Chemical properties are how a substance reacts with other stuff or conditions

Physical Properties

Density, color, hardness, melting point, boiling point are physical properties.

Classification of Matter

Terms

1. Mixture-

   a. Any substance that can be taken apart by physicals means

   b. two or more kinds of matter combined together where each kind of matter retains its physical properties.

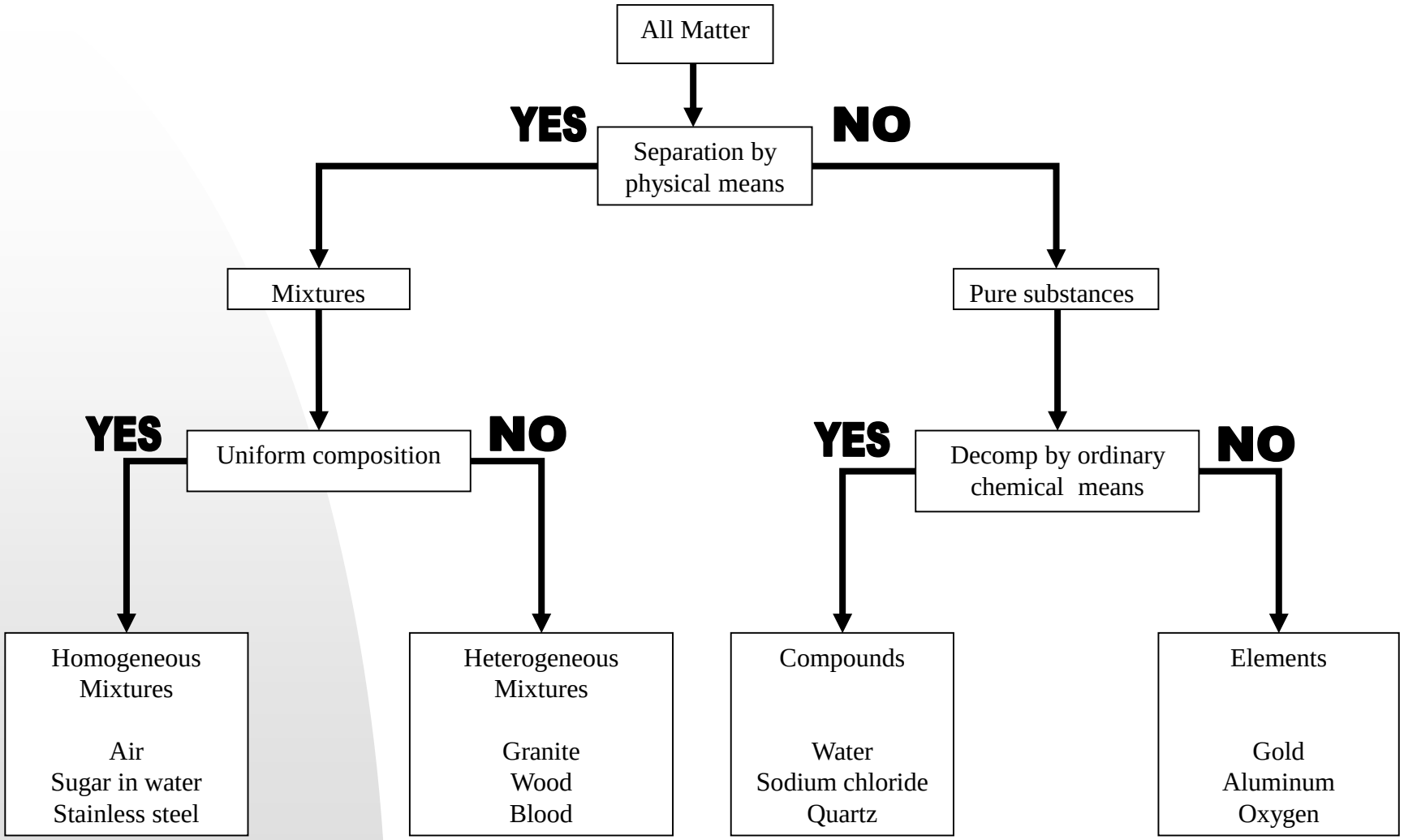
   2.Pure substance- any substance that can not be taken apart by physical means (same stuff throughout)

   3. Physical means – a way to separate a mixture without changing the substances that make it up.

Classification of Matter

4. Homogeneous mixture (solution) – a substance that has the same composition throughout (uniform composition)
5. Heterogeneous mixture- a substance that has varying composition throughout (no uniform composition)
6. Elements- any substance that cannot be broken down by ordinary chemical means. Made up of one kind of atoms.
7. Compounds – any substance made of two or more elements that can be broken down by ordinary chemical means.

THE CLASSIFICATION OF MATTER



Changes in Matter

Two basic change types :

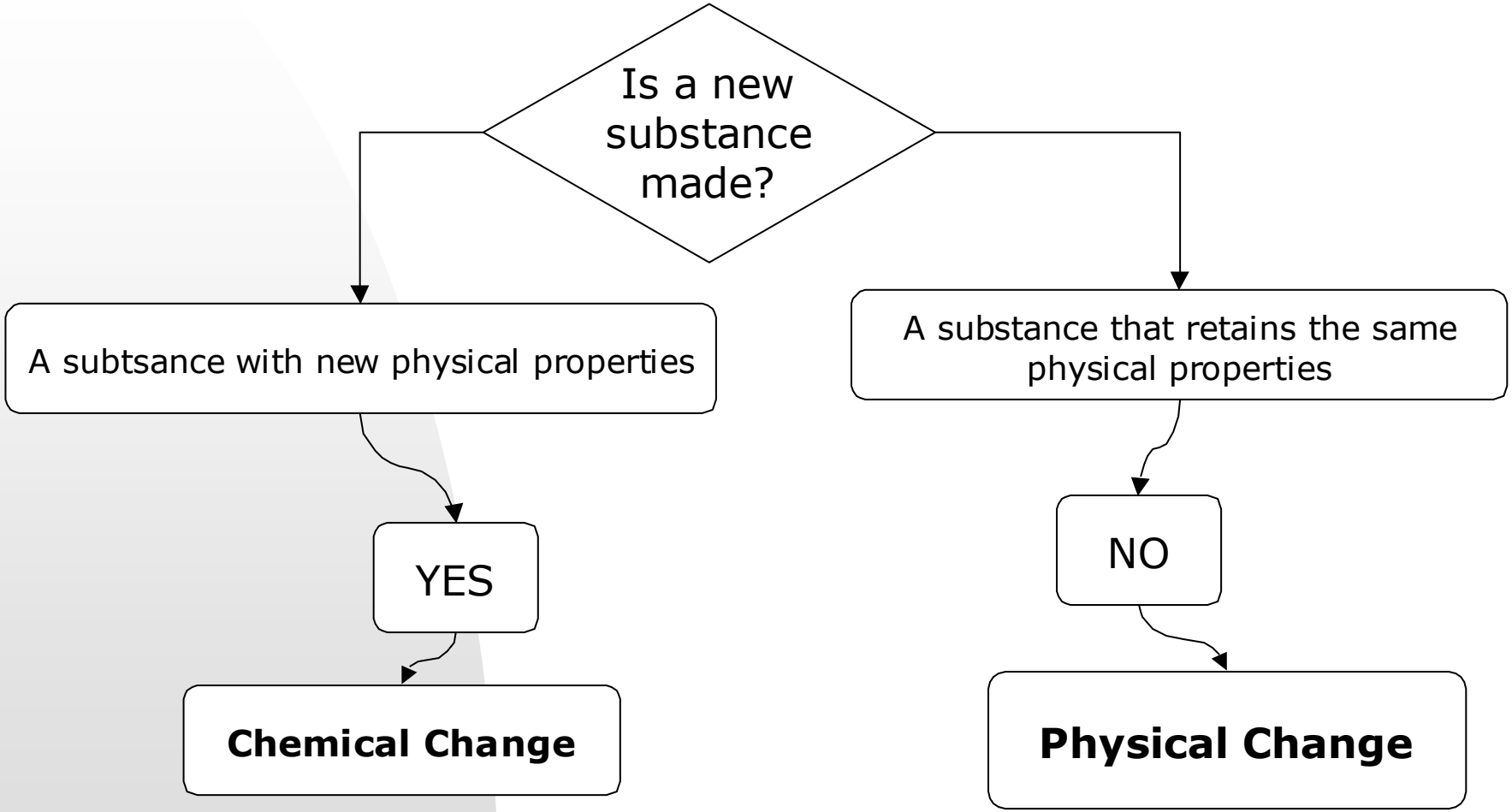
1. Changes that do not result in a new substance are called physical changes

2. Changes that result in a new substance are called chemical changes

Changes in Matter

- Now how do you tell the difference?
  - You pose the question: Is a new substance made doing this change?
    - If YES then a chemical change has occurred;
    - if NO then a physical change has occurred.

Classification of Changes



Evidence of Chemical Changes

- 1.The production of a precipitate (a water insoluble compound that ends up at the bottom of the test tube)
- 2.The release of heat (exothermic)
- 3.The release of light
- 4.The release of a gas
- 5.Change in color
- 6.The production of electricity

Things that promote Chemical Change

1. Addition of a catalyst (a substance that makes the chemical reaction work but does not change)
2. Exposure of the reactants to light (photography)
3. Heating the reactants
4. Passing electricity through the reactants
5. Putting the reactants into water solution
6. Stirring/agitating the reactants

Solids: Basic Information

- Definite shape : maintains its shape;
- Definite volume (all surfaces are free)
- Particles are very close together.
- Solids cannot be compressed

Liquids: Basic Information

1. NO definite shape(will take shape of container)
2. Definite volume
3. Particles are close together.
4. Fluidity (can flow or be poured) a measure of this is called viscosity.

Basic Information: Gasses

1. NO definite shape
2. NO definite volume
3. Particles are far apart.
4. Force of attraction between particles is very, very weak.

The Modern Periodic Table

- The known elements have been organized into a chart by their chemical and physical properties.

- In 1951, Glenn Seaborg was awarded the Nobel Prize in chemistry for his work on developing the Modern Periodic Table. Element 106 has been named seaborgium (Sg) in his honor.

Parts of the Periodic Table

Rows on the Periodic Table are called periods or series.

- They are numbered 1 to 7.
- The columns on the Periodic Table are called families or groups.
- The elements are grouped according to the physical and chemical properties.
- The columns a numbered 1 to 18
- The old system used Roman numerals and letters to denote groups and subgroups

Element Families on the Periodic Table

- The 112 elements can be divided, by their properties, into 9 separate families or groups.
- The elements are grouped together by similar chemical and physical properties.

Metals

- Elements in Groups 1-12 and some under the stair step.
- These elements have the characteristics of metals

Non-Metals

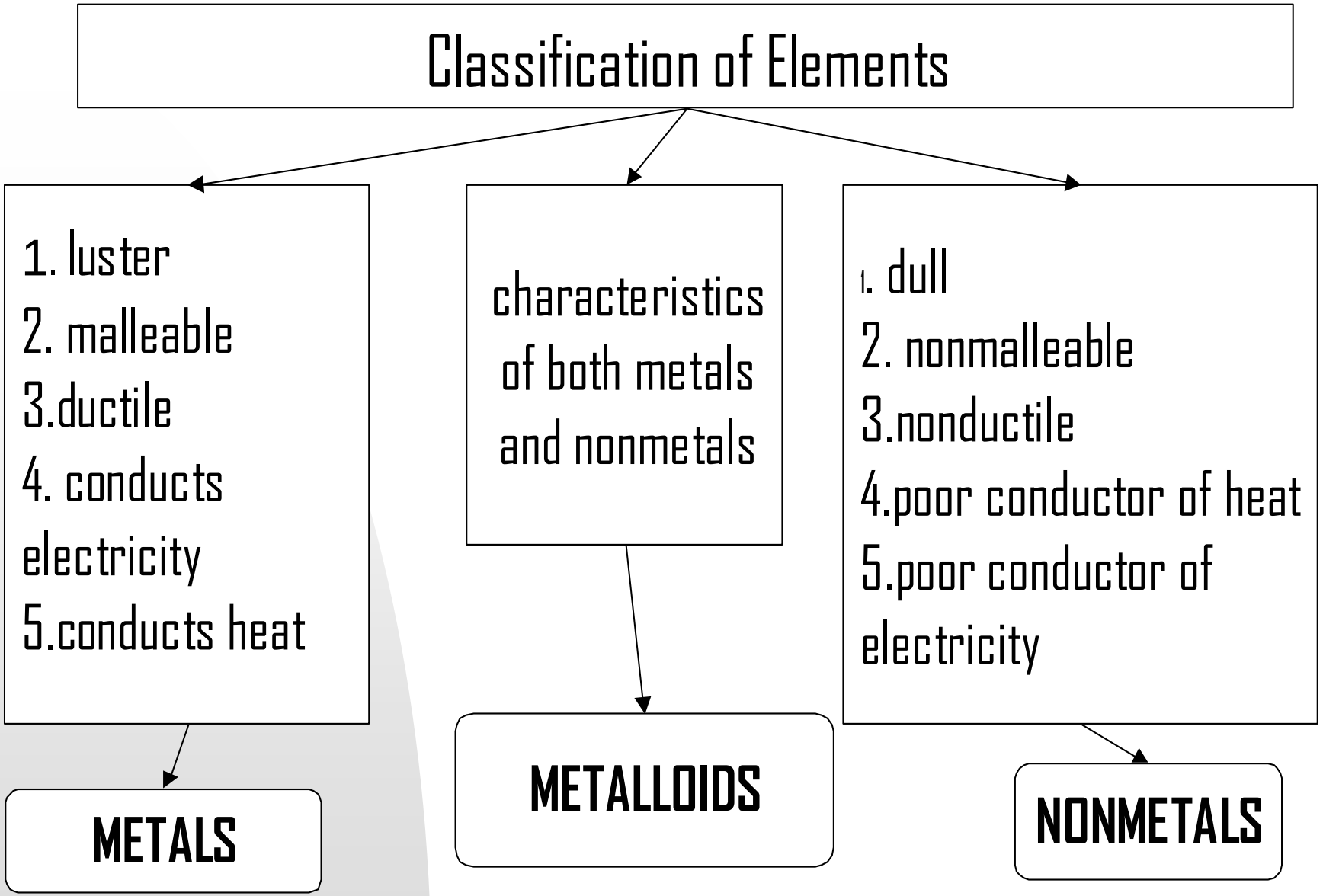
- Non-metals are the elements in groups 13 to 18.
- The non-metals are in two states of matter at room temperature gases (such as oxygen) and solids (such as carbon).

Metalloids

- Metalloids are the elements found along the stair-step line that distinguishes metals from non-metals.
- This line is drawn from between Boron and Aluminum to the border between Polonium and Astatine.
- Only exception to this is Aluminum, which is considered to be an "other metal".
- Metalloids have properties of both metals and non-metals.
- Metalloids, such as silicon and germanium, are semi-conductors. This property makes metalloids useful in computers and calculators

Noble Gases

- The six noble gases are found in Group 18.
- These elements are: helium, neon, argon, krypton, xenon, and radon.
- The noble gases have great difficulty forming compounds.
- Noble gases the most stable elements.


Classification of Elements
1. luster
2. malleable
3.ductile
4. conducts electricity
5.conducts heat
METALS
characteristics of both metals and nonmetals
METALLOIDS
1. dull
2. nonmalleable
3.nonductile
4.poor conductor of heat
5.poor conductor of electricity
NONMETALS

Energy and States of Matter

When energy is added to or taken away from a mass of matter,the matter may change state.

Energy and States of Matter

We call these changes melting, freezing, boiling,etc.

Energy and States of Matter

The energy that causes these changes is usually heat which is measured in calories or joules.

Heat in; Heat out

Heat is usually released or absorbed doing a physical or chemical change.

Two terms are applied to that show which way the heat flows: endothermic and exothermic

Endothermic processes
Require heat to be added
Or absorbed
EX: ice melting

Exothermic processes are those processes that will release heat energy.
Ex: Steam condensing and Most chemical reactions

Two things about heat:
Heat always travels from Higher to lower (hot to cold)
Heat is a form of energy and therefore can only be transformed

Heat cannot be directly measured.It can be indirectly measured by changes in temperature.

Entropy

Entropy is a measure of disorder something has.
Higher entropy is more disorder (disorganization).
Lower entropy less disorder(more organized)

Explanation: Water

The water molecules in ice are well organized into a crystal. They have low energy and low entropy.

The water molecules in steam have high energy and high entropy. These molecules are all over the place.

So. Let's make some general statements about energy and entropy.

1. Nature tends to move to higher entropy but to a lower amt of energy.

2. Add more energy and the degree of entropy will increase.
3. Take energy away and the degree of entropy decreases.